

Penn Cambria Curriculum

Course Name	Honors Physics
Length of Course	<i>1 credit (1 period per day for one semester)- Weighted at 1.10 for GPA calculations</i>
Grade Level	<i>11-12</i>
Prerequisites	<i>85% or above in Algebra 2 or Geometry</i>
Course Description	<p><i>This is a more rigorous course that includes essentially the same curricular content as Physics. However, this course will include a more in-depth study with class discussions, written analysis and outside readings. This course may be taken for dual enrollment college credit through St. Francis University.</i></p> <p><i>Physics is the study of the physical world about us. It stresses real-life applications of physical principles and processes in order to create scientifically literate individuals. An understanding of physics will allow students to make knowledgeable decisions about political, social, and environmental issues. The course emphasizes critical thinking and problem solving skills. Using a variety of techniques, students will study scientific method, measurement, energy transformations, principles of motion, forces, work, power, waves and graphical analysis. Emphasis is placed on student participation in the laboratory for discovery, application and validation.</i></p>
Units of Study	<p><i>Measurement (Physics Toolkit)</i></p> <p><i>Mechanics / Motion and Force</i></p> <p><i>Waves</i></p> <p><i>Energy</i></p> <p><i>Career Exploration</i></p>
Materials	<p><i>Text: <u>Glencoe Physics</u> c2005</i></p> <p><i>Supplemental Materials: Lab materials, Current academic readings including magazines, journals and online resources</i></p>

At Penn Cambria High School, all core subject courses are aligned to the Pennsylvania Academic Standards and focus on ensuring students have a solid understanding of core concepts. In addition, all courses encourage critical thinking and an in-depth analysis of subject matter in addition to building a strong foundation.

The primary goal of the honors level curriculum alternative for these core courses is to provide students with a more in-depth study of the concepts by deepening the academic study and more academic reading. Students in the honors level of a core course will be expected to engage in analysis, evaluation and synthesis level activities with more frequency and for a longer duration than that found in the non-honors level course.

Students in Honors Physics will not only learn physics concepts, but also be expected to apply, analyze and evaluate these concepts in real and simulated scenarios. Students in Honors Physics will not only be expected to demonstrate proficiency with regards to physics concepts, but also the integrated mathematical concepts inherent in collegial level study of physics.

Unit: A Physics Toolkit / Measurement

Estimated Time: 1 – 2 weeks

Standard Alignment:

3.7.12B – Evaluate appropriate instruments and apparatus to accurately measure materials and processes.

Curricular Objectives:

- A. Students will:
 - a. Use mathematical tools to measure and predict
 - b. Apply accuracy and precision when measuring
 - c. Create and evaluate data graphically.

Assessments/ Measurement of Objectives:

- Objective tests with application and analysis
- Lab observations / assessments

Suggested Methods of Instruction / Learning Activities:

- ✓ Inverse Relationship Lab
- ✓ Quadratic Relationship Lab
- ✓ Linear Relationship Lab

Unit: Mechanics/ Motion and Force

Estimated Time: 10 – 12 weeks

Standard Alignment:

- 3.2.12A – Evaluate the nature of scientific and technological knowledge.
- 3.2.12B – Evaluate experimental information for appropriateness and adherence to relevant science processes.
- 3.2.12C – Apply the elements of scientific inquiry to solve multi-step problems.
- 3.4.12 C Apply the principles of motion and force

Curricular Objectives:

- A. Students will:
 - 1. Representing Motion:
 - a. Represent motion through the use of words, *motion diagrams*, and *graphs*.
 - b. Use the terms *position*, *distance*, *displacement*, and *time interval* in a scientific manner to describe motion.
 - 2. Accelerated Motion
 - a. Develop descriptions of accelerated motions.
 - b. Use graphs and equations to solve problems involving moving objects.
 - c. Analyze the motion of objects in free fall.
 - 3. Forces in One Dimension
 - a. Use Newton's laws to solve problems
 - b. Determine the magnitude and direction of the net force that causes a change in an object's motion.
 - c. Classify forces according to the agents that cause them.
 - 4. Forces in Two Dimensions
 - a. Represent vector quantities both graphically and algebraically.
 - b. Use Newton's laws to analyze motion when friction is involved.
 - c. Use Newton's laws and knowledge of vectors to analyze motion in two dimensions.
 - 5. Motion in Two Dimensions
 - a. Use Newton's laws and knowledge of vectors to analyze motion in two dimensions.
 - b. Solve problems dealing with projectile and circular motion.
 - c. Solve relative velocity problems.
 - d. Interpret a model that illustrates circular motion and acceleration.
 - 6. Momentum and Its Conservation
 - a. Describe momentum and impulse and apply these concepts to the interactions between objects.
 - b. Relate Newton's third law of motion to conservation of momentum.
 - c. Explore the momentum of rotating objects and torque
 - d. Explain common phenomena (rock in landslide, car hitting patch of ice, etc.) using an understanding of momentum.
 - 7. Simple and Compound Machines
 - a. Propose and produce modifications to specific mechanical power systems that will improve their efficiency
 - b. Design or evaluate simple technology or natural systems that incorporate principles of force and motion (simple and compound machines)
 - c. Calculate the mechanical advantage for moving an object by using simple machine.
 - d. Identify elements of simple machines in compound machines.

Assessments/ Measurement of Objectives:

- Objective tests including application and analysis
- Lab observations/assessments
- Projects
- Written analysis

Suggested Methods of Instruction / Learning Activities:

- ✓ Motion Diagram Lab
- ✓ Collision Lab
- ✓ Predicting from Graph Lab
- ✓ Average Speed Lab
- ✓ Acceleration Lab
- ✓ Measure Gravity Lab
- ✓ Average and Final Velocity Lab
- ✓ High Jump Lab
- ✓ Leg Strength Lab
- ✓ Newton's 2nd Law Lab

- ✓ Weight Versus Mass Lab
- ✓ Vector Addition Lab
- ✓ Friction Lab
- ✓ Incline Lab
- ✓ Projectile Lab
- ✓ Centripetal Lab
- ✓ Impulse-Momentum Lab
- ✓ Conservation of Momentum Lab
- ✓ Simple Machine Lab

Unit: Waves

Estimated Time: 2 – 4 weeks

Standard Alignment:

- 3.2.12A – Evaluate the nature of scientific and technological knowledge.
- 3.2.12B – Evaluate experimental information for appropriateness and adherence to relevant science processes.
- 3.2.12C – Apply the elements of scientific inquiry to solve multi-step problems.
- 3.4.12C – Apply the principles of motion and force.

Curricular Objectives:

- A. Students will:
 - 1. Vibrations and Waves
 - a. Examine vibrational motion and analyze how it relates to waves.
 - b. Determine how waves transfer energy.
 - c. Describe wave behavior and analyze its practical significance.
 - d. Evaluate wave properties of frequency, wavelength, and speed as applied to sound and light through different media
 - e. Compare or analyze waves in the electromagnetic spectrum (e.g. ultraviolet, infrared, visible light, X-rays, microwaves) as well as their properties, energy levels and motion.
 - 2. Sound
 - a. Describe sound in terms of wave properties and behavior.
 - b. Analyze sources of sounds.
 - c. Explain properties that differentiate between music and noise.

Assessments/ Measurement of Objectives:

- Objective tests including application and analysis
- Lab observations/assessments
- Projects
- Written analysis

Suggested Methods of Instruction / Learning Activities:

- ✓ Hooke's Law Lab
- ✓ Modeling Waves Lab
- ✓ Wave Interaction Lab
- ✓ Pendulum Lab
- ✓ Sound Characteristics Lab
- ✓ Band Music Lab
- ✓ Speed of Sound Lab

Unit: Energy

Estimated Time: 3 – 6 weeks

Standard Alignment:

3.2.12B – Evaluate experimental information for appropriateness and adherence to relevant science processes.

3.2.12C – Apply the elements of scientific inquiry to solve multi-step problems.

3.4.12B – Apply and analyze energy sources and conversions and their relationship to heat and temperature.

3.8.12B – Apply the use of ingenuity and technological resources to solve specific societal needs and improve the quality of life.

3.8.12C – Evaluate the consequences and impacts of scientific and technological solutions.

Curricular Objectives:

A. Temperature and Heat

- a. Analyze how temperature relates to the potential and kinetic energies of atoms and molecules.
- b. Distinguish heat from work.
- c. Calculate heat transfer and the absorption of thermal energy.
- d. Explain the expansion and contraction of matter caused by changes in temperature.
- e. Apply Pascal's, Archimedes', and Bernoulli's principles in everyday situations.

B. Energy

- a. Explain how energy is a property of an object that can change the object's position, motion, or its environment.
- b. Explain how energy changes from one form to another, and that the total amount of energy in a closed system remains constant.
- c. Give examples of renewable and nonrenewable energy sources and explain the environmental and economic advantages and disadvantages of both.
- d. Identify different sources of energy used by living things, and trace each source back to the sun.
- e. Analyze the advantages and disadvantages of several energy sources, including the environmental impacts of energy use (logging, mining, etc).
- f. Explain the practical use of alternative sources of energy to address environmental problems.
- g. Describe the types of conversion processes necessary for different energy sources to produce electricity.
- h. Apply the knowledge to conversion of energy to explain common systems (refrigeration, rocket propulsion, heat pump)
- i. Explain how electricity induces magnetism and how magnetism induces electricity as two aspects of a single electromagnetic force.
- j. Use Ohm's Law to explain relative resistances, currents and voltage.

Assessments/ Measurement of Objectives:

- 5-10 page Research Paper based on current energy topics
- Presentation based on research
- Objective tests with application and analysis
- Lab observations/assessments
- Projects
- Written analysis

Suggested Methods of Instruction / Learning Activities:

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|---------------------------|---------------------------|
| ✓ Research | ✓ Buoyant Force Lab |
| ✓ Specific Heat Lab | ✓ Combined Gas Law Lab |
| ✓ Final Temperature Lab | ✓ Thermal Expansion Lab |
| ✓ Heating and Cooling Lab | ✓ Evaporative Cooling Lab |
| ✓ Pressure Lab | ✓ Electromagnetic Lab |

Unit: Modern Issues in Physics

Estimated Time: 1-2 weeks - Ongoing Throughout the Semester

Standard Alignment:

- 13.1.11C – Analyze career options based on personal interests, abilities, aptitudes, achievements and goals.
- 3.2.12A – Evaluate the nature of scientific and technological knowledge
- 3.2.12 B – Evaluate experimental information for appropriateness and adherence to relevant science processes

Curricular Objectives:

- A. Students will:
 - a. Analyze the role physics concepts play in modern science and current events.
 - b. Evaluate experimental information with regards to the experimental limits.
 - c. Judge whether conclusions presented in academic research are consistent and logical.
 - d. Use knowledge gained through continued academic reading to predict new information or analyze the impact of the information contained in the reading to the future of science.
 - e. Describe various employment opportunities in Physics

Assessments/ Measurement of Objectives:

- Written reactions/analysis of academic readings
- Presentations

Suggested Methods of Instruction / Learning Activities:

- ✓ Research
- ✓ Database use for location of academic readings
- ✓ Discussion boards or class discussions based on reading reactions